



NORTH DAKOTA DEPARTMENT OF HEALTH
Environmental Health Section

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Bismarck, ND 58504-5264

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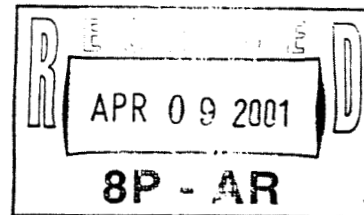
701-328-5200

Mailing Address:

P.O. Box 5520
Bismarck, ND 58506-5520

April 2, 2001

Richard R. Long, Director
Air and Radiation Program
U.S. EPA, Region VIII
One Denver Place
999 18th Street, Suite 300
Denver, CO 80202-2466



Dear Dick:

Enclosed is the modeling protocol the North Dakota Department of Health will utilize to determine the status of PSD Class I increment consumption for SO₂. The protocol was developed and is submitted per agreement at our January 10, 2001 meeting, as summarized in my March 13, 2001 letter. It is our understanding that you will complete your review of this protocol within 30 days.

We propose to use the Calpuff model in our analysis as you indicated this was EPA's preferred model. However, as we pointed out in the January 10, 2001 meeting, this model is not an approved model. For the model to be adopted in North Dakota it will be necessary for the Department to update our PSD rules to incorporate the latest version of 40 CFR 51, Appendix W (Guideline on Air Quality Models) once the Calpuff model is approved. Our current rules require the use of models included in the "Guideline on Air Quality Models" as of March 1994 or alternative models that have been subjected to public notice, public comment, and written approval by the Department and EPA.

If you have any questions regarding this protocol, please contact Steve Weber (701-328-5188).

Sincerely,

Francis J. Schwindt, Chief
Environmental Health Section

FJS/SFW:saj
Attach:

Environmental Health
Section Chief's Office
701-328-5150

Air
Quality
701-328-5188

Municipal
Facilities
701-328-5211

Waste
Management
701-328-5166

Water
Quality
701-328-5210

**North Dakota Department of Health (NDDH)
Class I Increment Analysis for SO₂
Modeling Protocol**

I. General

- **Basis for Modeling Protocol** - Modeling protocol is consistent with the EPA "Guideline on Air Quality Models"¹ and "Interagency Workgroup for Air Quality Modeling (IWAQM) Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts."² Protocol is also based on extensive NDDH experience with the CALPUFF modeling system.
- **Class I Areas** - Analysis will include Theodore Roosevelt National Park (3 units) and Lostwood Wilderness Area in North Dakota, and Medicine Lake Wilderness Area and Fort Peck Reservation in Montana.
- **Meteorological Model** - CALMET Version 5.2
- **Dispersion Model** - CALPUFF Version 5.4
- **Postprocessing Software** - CALPOST (part of CALPUFF system) and North Dakota Department of Health CITOVS³ (CALPUFF Increment Tracking and Output Visualization System).
- **Modeling Domain/Computational Grid** - Computational grid will be based on grid cell size of 10 km and will extend 640 km east-west and 460 km north-south, as illustrated in Figure 1. In the vertical, the computational grid will be defined by eight vertical layers with cell face heights at 22, 50, 100, 250, 500, 1000, 2000, and 4000 meters above ground level. The grid system will be fit to Lambert conformal mapping to account for the earth's curvature.

¹CFR, 1999. EPA Guideline on Air Quality Models. 40 CFR (Code of Federal Regulations) Part 51, Appendix W.

²EPA, 1998. IWAQM Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts. Publication No. EPA-454/R-98-019, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina 27711.

³NDDH, 1999. Calpuff Increment Tracking and Output Visualization System. North Dakota Department of Health, Bismarck, North Dakota 58506

- **Meteorological Data** - One year of data (calendar year 2000) will be utilized.
- **Emission Inventory** - The emission inventory will include all major SO₂ sources located within 250 km of Class I areas in North Dakota. The inventory will include minor SO₂ sources located within 50 km of Class I areas (North Dakota only). All sources will be modeled with CALPUFF.

II. Meteorological Data Processing with CALMET

- **Surface Meteorological Data** - Surface data, for a minimum of 25 stations located on or near the computational grid, will be obtained from the National Climatic Data Center. Preprocessing and quality assurance checks will be accomplished with Earth Tech⁴ (CALPUFF model developer) software programs METSCAN and SMERGE.
- **Upper-Air Meteorological Data** - Upper-air data, for a minimum of 6 stations located on or near the computational grid, will be obtained from the National Climatic Data Center. Preprocessing and quality assurance checks will be accomplished with Earth Tech software program READ62.
- **Precipitation Data** - Hourly precipitation data, for a minimum of 100 stations located on or near the computational grid, will be obtained from the National Climatic Data Center. Preprocessing and quality assurance checks will be accomplished with Earth Tech software programs PXTRACT and PMERGE.
- **Geophysical Data** - Terrain elevation and land use data required by CALMET will be obtained from United States Geological Survey 1:250,000-scale Digital Elevation Models (DEM) and 1:250,000-scale Land Use and Land Cover (LULC) files, respectively. Necessary preprocessing of terrain elevation and land use data will be accomplished using Earth Tech software programs TERREL, CTGCOMP, CTGPROC, and MAKEGEO.
- **CALMET Control File** - To the extent possible, CALMET technical options and input parameters, which must be specified in the control file, will be set according to IWAQM guidance. For

⁴Earth Tech, Inc., Concord, Massachusetts

options which IWAQM leaves unspecified, the NDDH will base settings on previous experience with the modeling system.

III. CALPUFF Modeling

- **Source Data** - SO₂ emission rates and stack parameters for major sources will be based on actual hourly values concurrent with year 2000 meteorological data. Actual emission rate and volume flow rate for major source generating stations will be obtained from the EPA acid rain database (CEM). Exit temperature for major source generating stations, as well as all actual data for other major sources, will be obtained directly from the operators. SO₂ emission rates and stack parameters for minor sources, primarily oil and gas production related, will be based on year 2000 monthly production data obtained from the State Industrial Commission Oil and Gas database. The source inventory will include the PSD-increment-consuming/expanding emissions (if any) associated with:

- Coal Creek Station
- Antelope Valley Station
- Coyote Station
- Leland Olds Station
- Stanton Station
- Milton R. Young Station
- Great Plains Synfuels Plant
- Little Knife Gas Plant
- Grasslands Gas Plant
- BP/Amoco Mandan Refinery
- Colstrip Station (Montana)
- CELP Boiler (Montana)
- Heskett Station (inc. expanding)
- Tioga Gas Plant (inc. expanding)
- Neal Station (inc. expanding)
- Flying J Refinery (inc. expanding)
- Beulah Station (inc. expanding)
- Royal Oak Briquetting (inc. expanding)
- Numerous Oil and Gas Production Sources

- **Receptor Locations** - Receptor locations (discrete) for North Dakota Class I areas are shown in Figure 2. Receptor locations (discrete) for Montana Class I areas are shown in Figure 3. Gridded receptors may also be added to accommodate visualization or other regional interpretation of model output.

- **Ammonia and Ozone Background** - Ammonia and ozone background concentrations will be based on data from NDDH monitoring sites.
- **CALPUFF Control File** - To the extent possible, CALPUFF technical options and input parameters, which must be specified in the control file, will be set according to IWAQM guidance. For options which IWAQM leaves unspecified, the NDDH will base settings on previous experience with the modeling system. In addition, the NDDH has conducted a CALPUFF model performance evaluation which suggests that modification of some IWAQM-recommended settings will yield better agreement between predictions and observations (for example, the use of dispersion coefficients calculated from micrometeorological variables, rather than Pasquill-Gifford dispersion coefficients). The NDDH will use those options which provide best agreement with observations.
- **CALPUFF Execution and Postprocessing** - CALPUFF will be executed on an individual-source basis. Cumulative summary results will be obtained through postprocessing of CALPUFF individual-source output using CITOVs and CALPOST.

Figure 1: Location of Computational Grid and Class I Areas

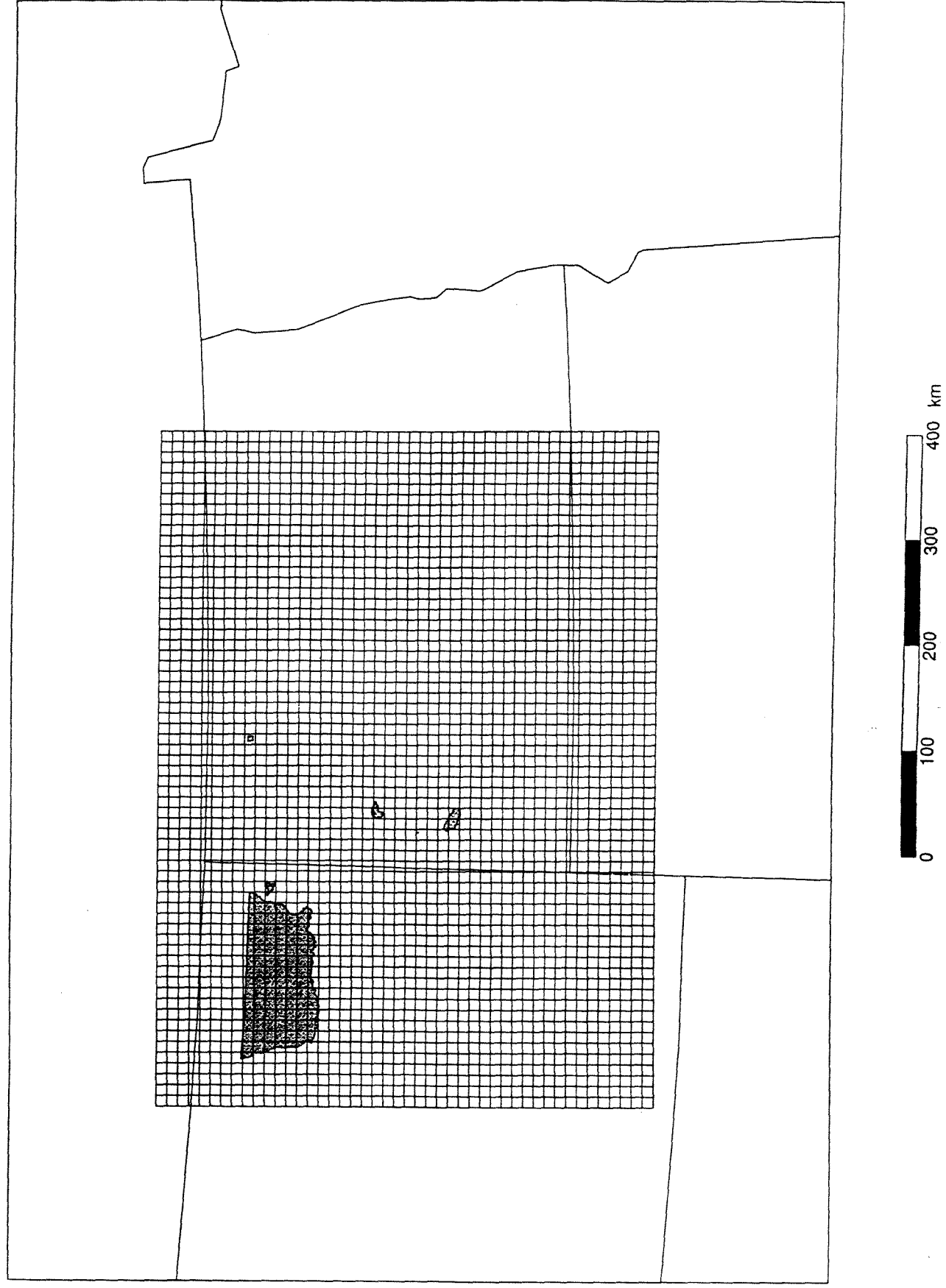


Figure 2: Receptor Locations - North Dakota Class I Areas

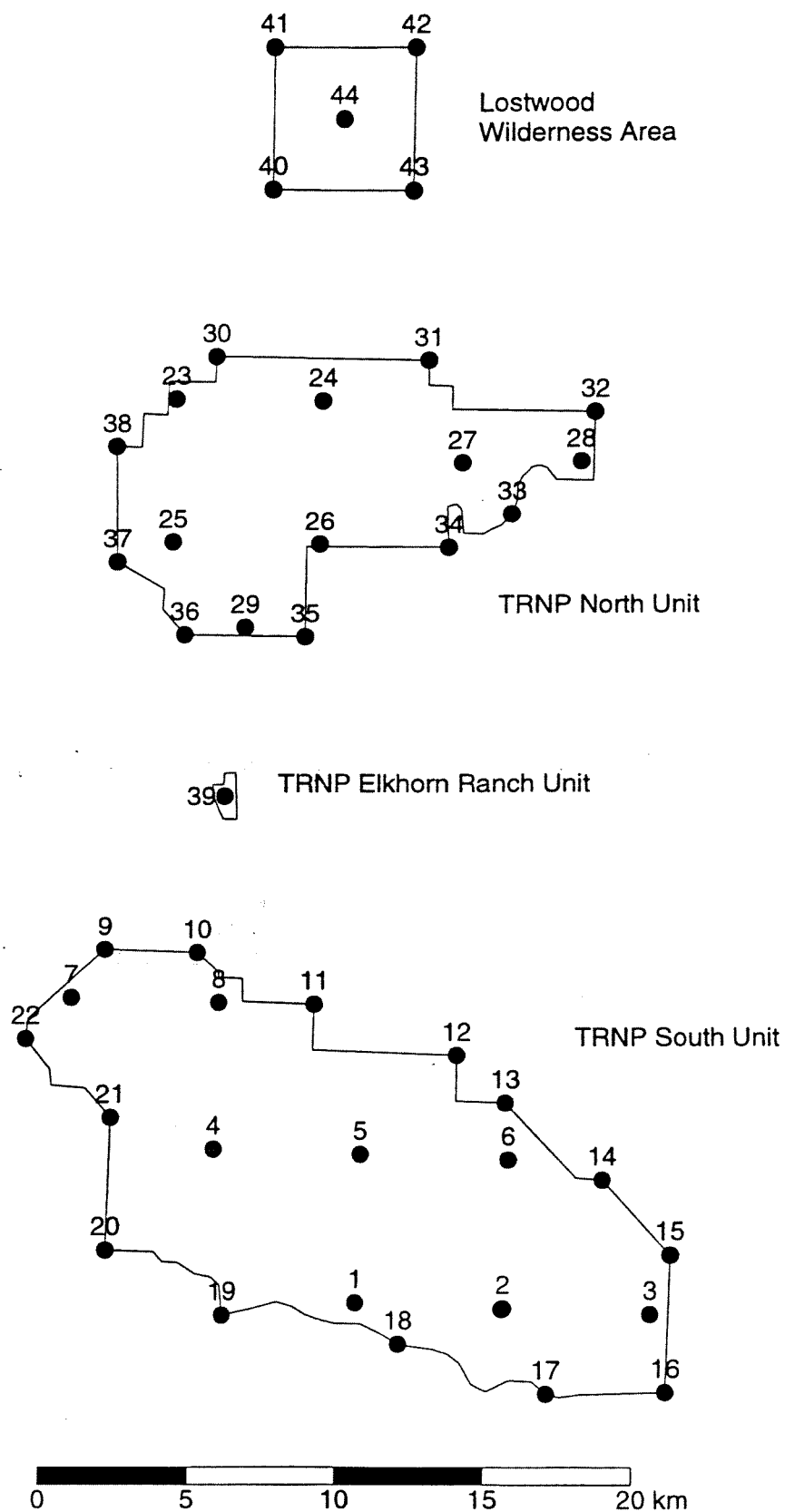
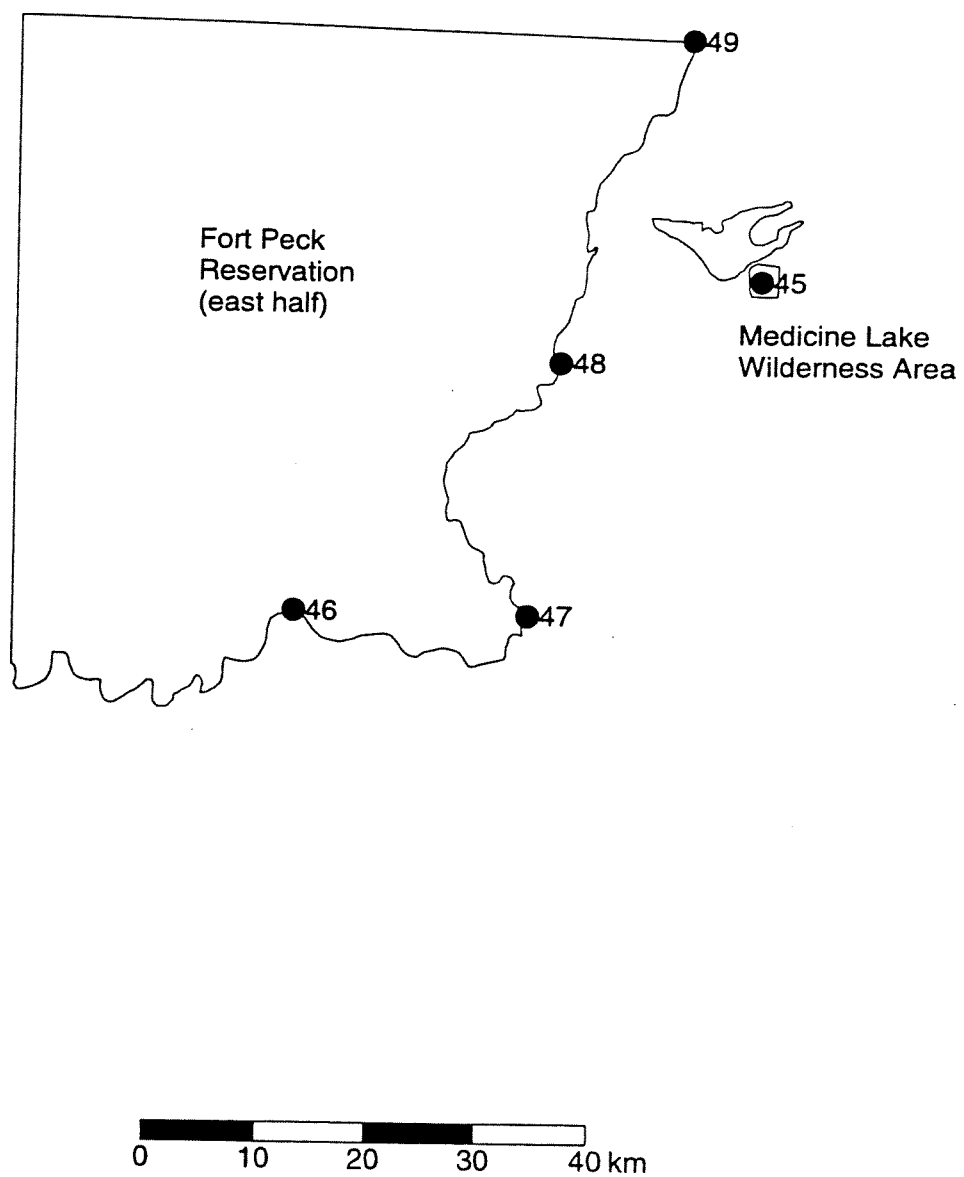
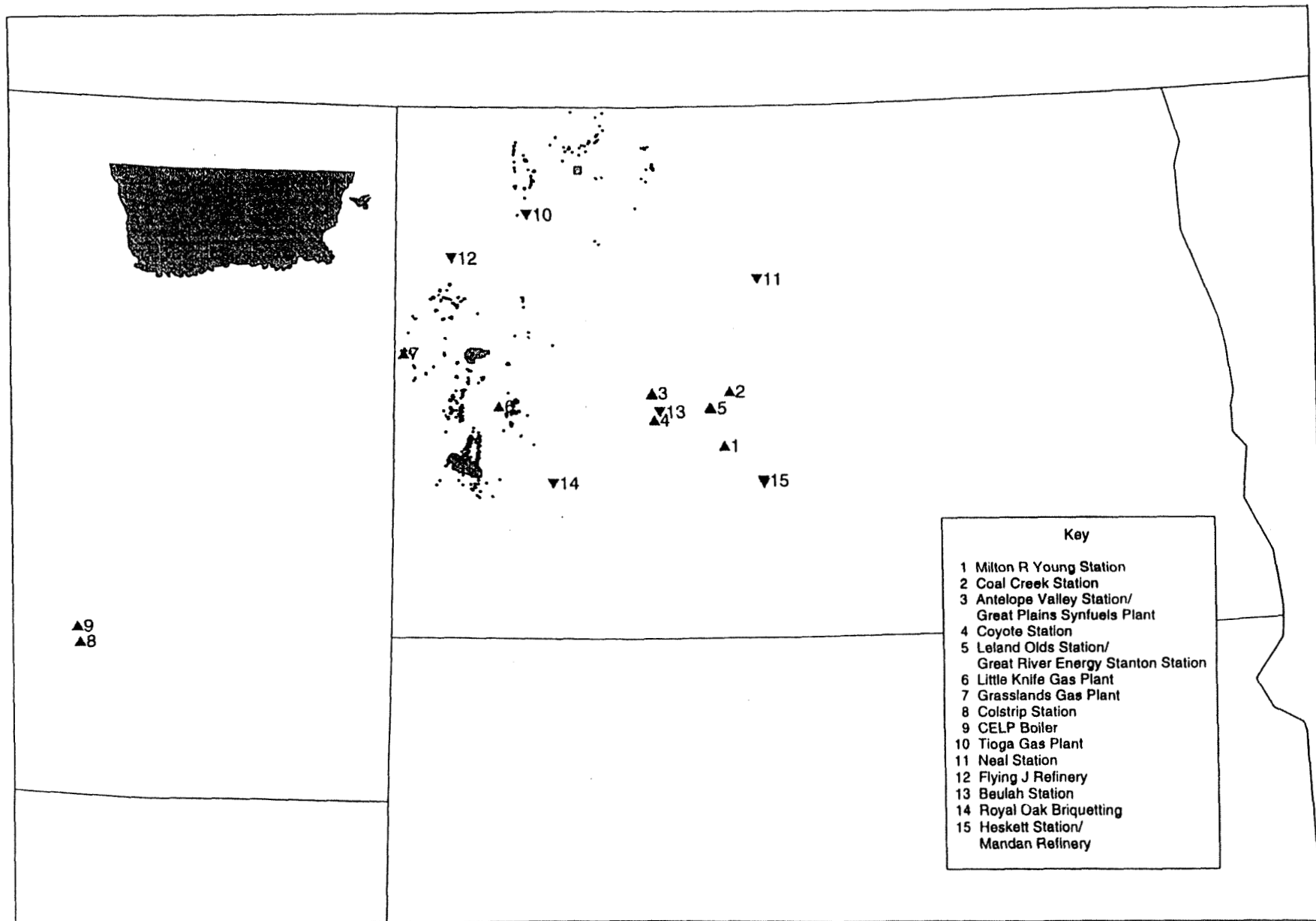


Figure 3: Receptor Locations - Montana Class I Areas



Source Locations and Class I Areas



- ▲ Major Source
- ▼ Increment-Expanding Source
- Minor Source